



Display System Having a Three-Dimensional Convex
Display Surface; Inventors: STEVEN W. UTT et al.;
Serial No.: 10/613,449; Docket No.: 23242-07464

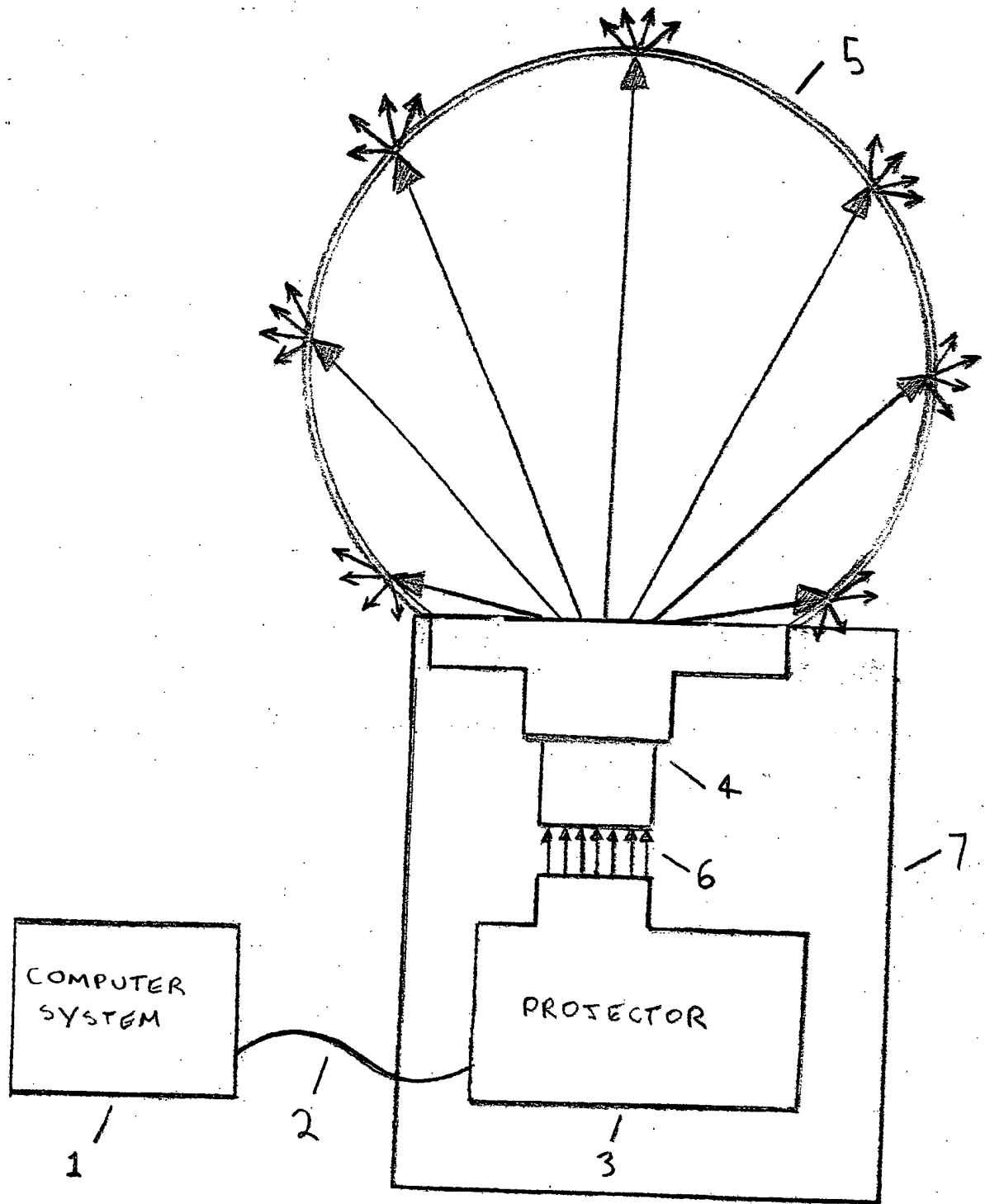


FIG. 1

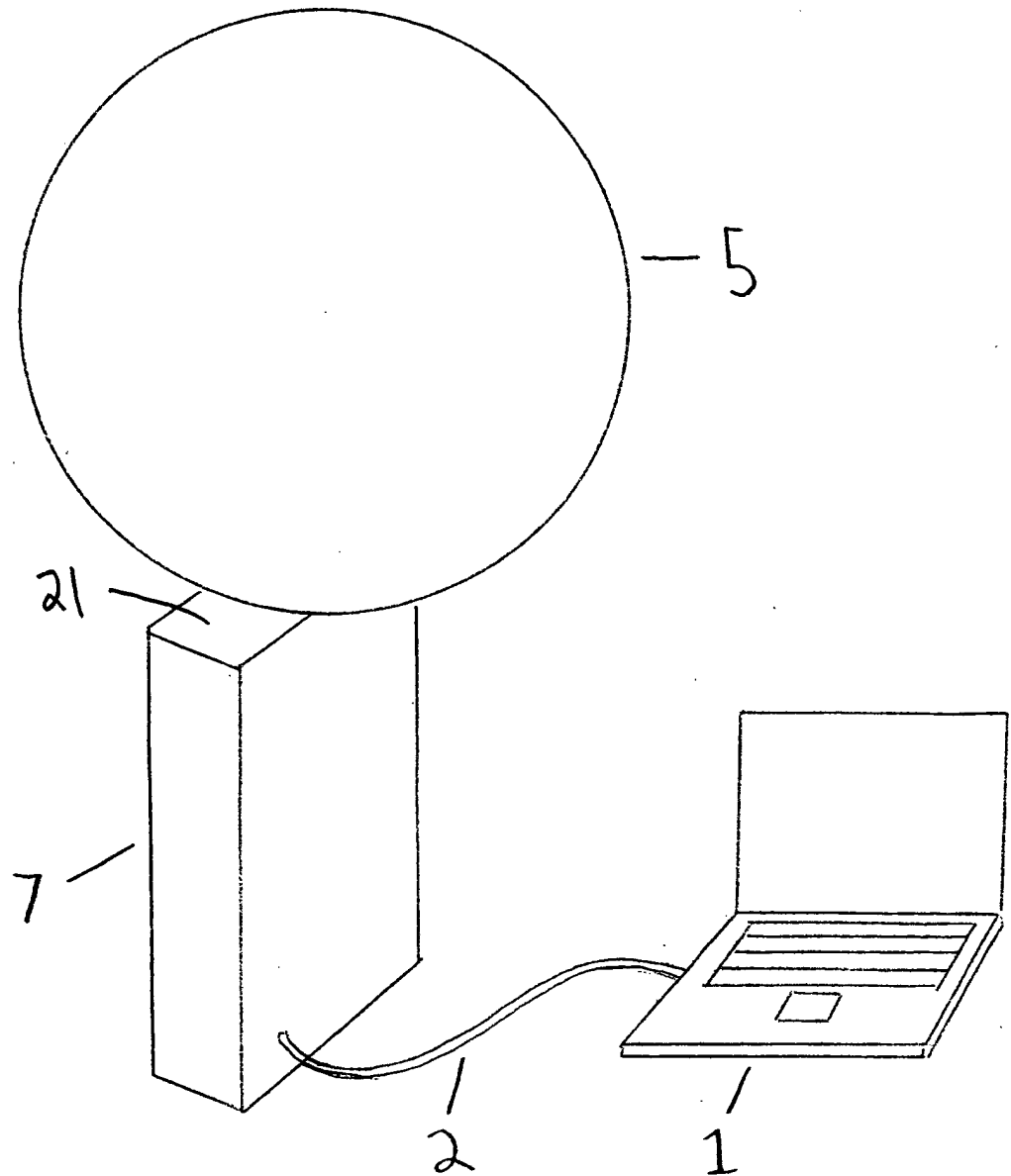


FIG. 2A

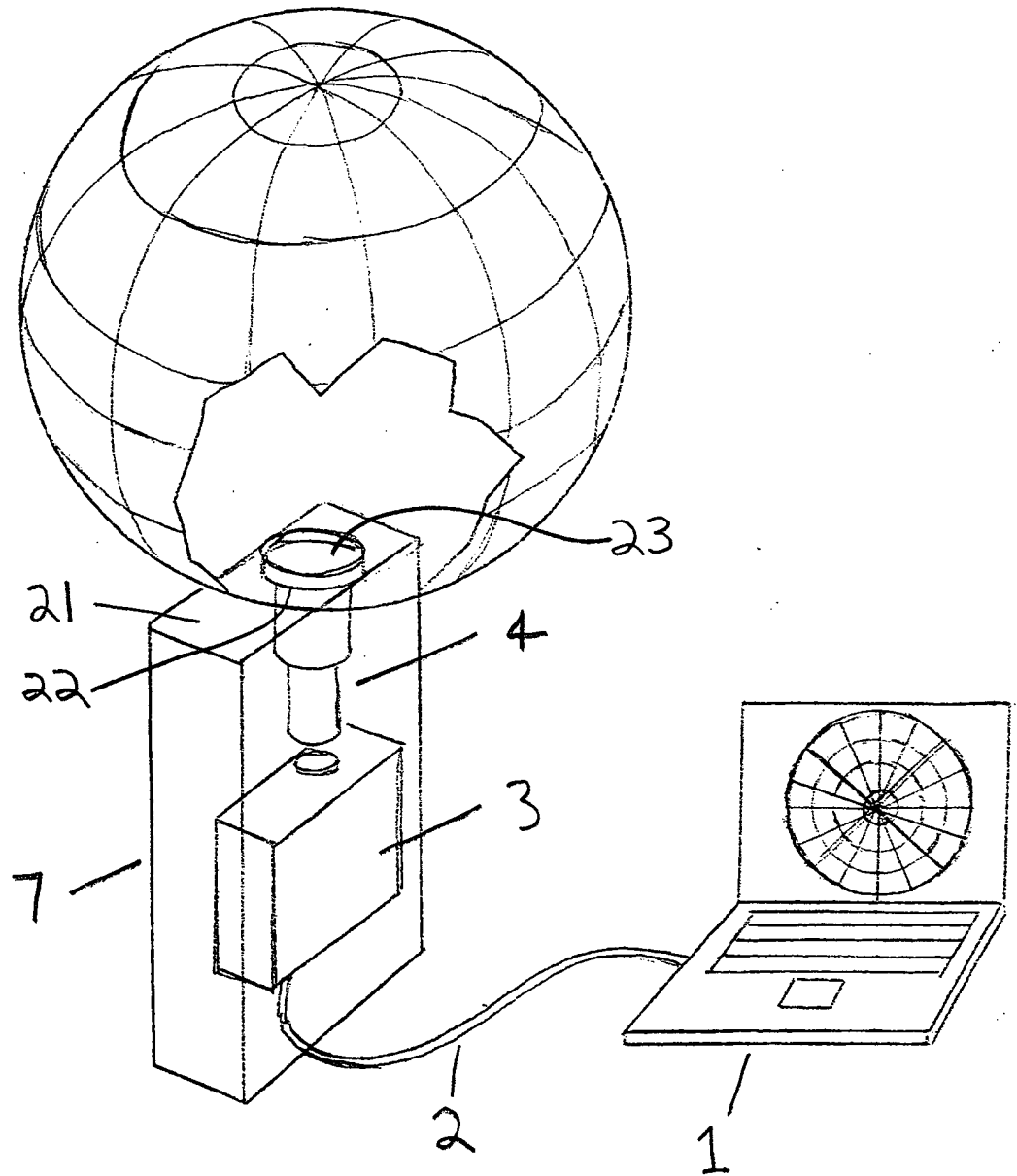
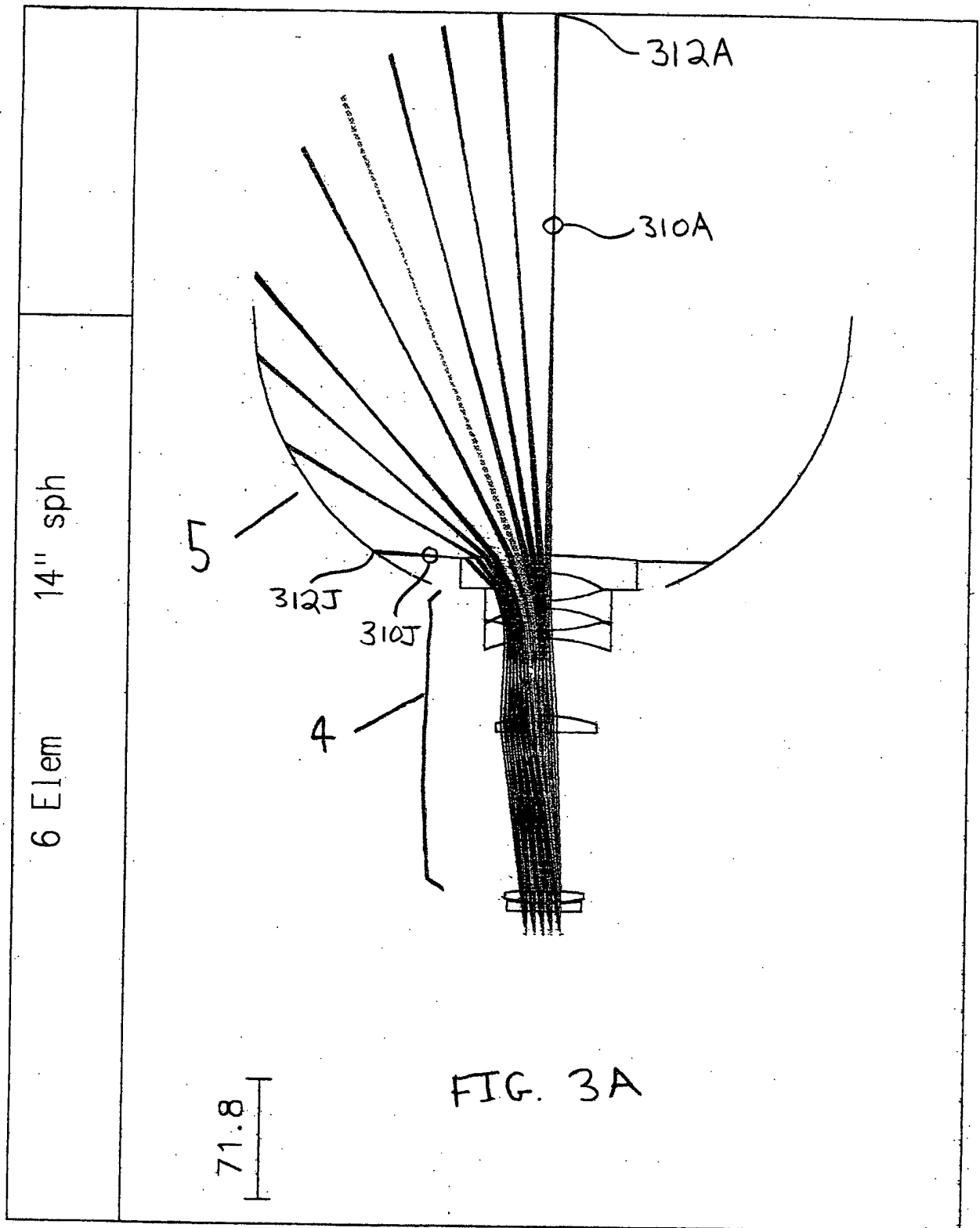


FIG. 2B



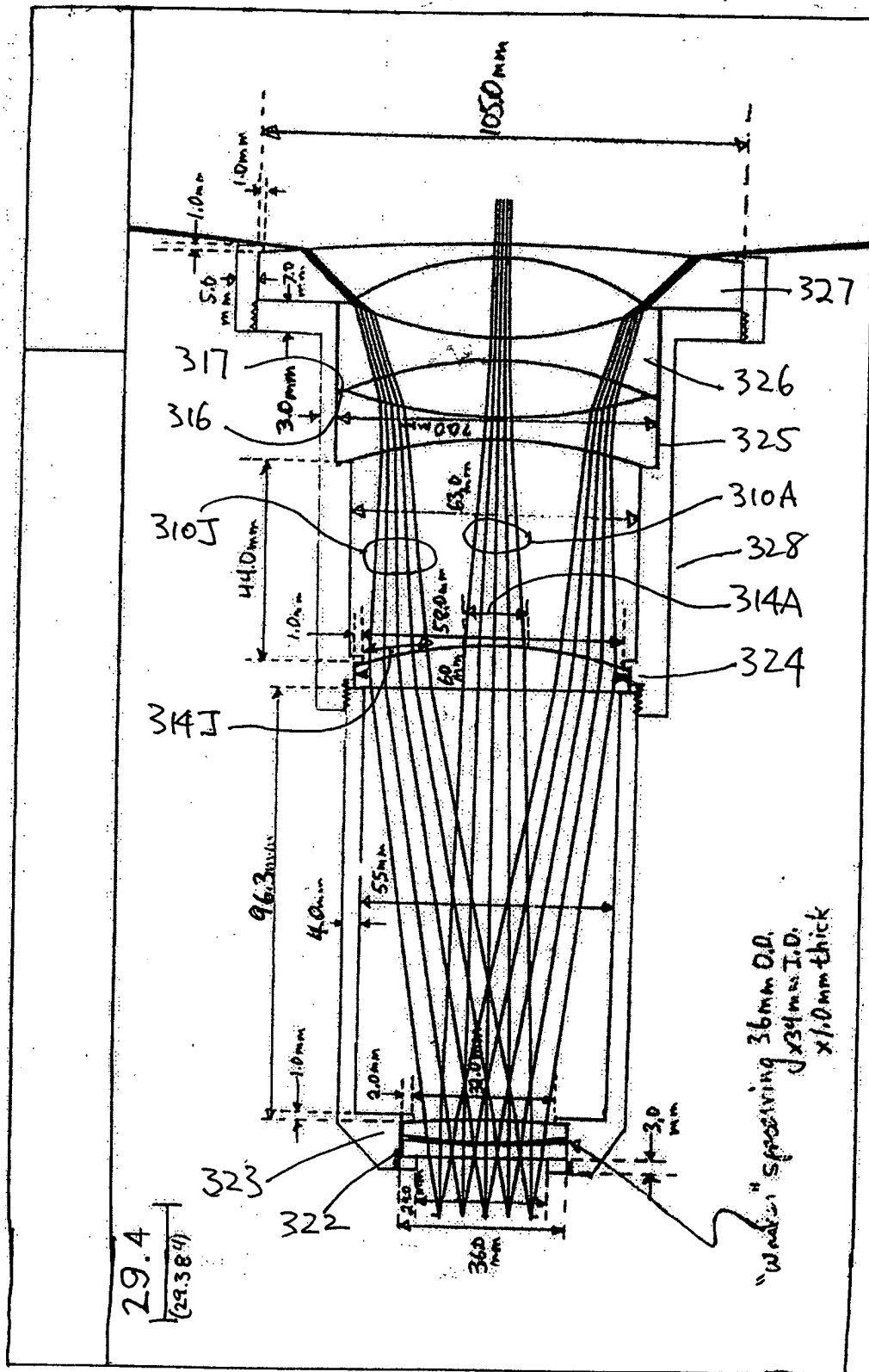


FIG. 3B

*LENS DATA

SRF OBJ	RADIUS	THICKNESS	APERTURE RADIUS	GLASS	SPE	NOTE
AST	--	-1.6000E+03	292.000000	AIR		
2	--	13.000000	10.000000 A	AIR		
JML	67891 PCV SF10	4.500000	22.000000	SF10	C	
3	168.260000	0.500000	22.000000 P	AIR		
4	122.680000	7.090000	23.240000	BK7	C	
JML	70552 DCX BK7					
5	-178.870000	94.518476 V	23.240000 P	AIR		
6	--	10.000000	30.000000	CARBO	C	
7	--	45.913584 V	30.000000	AIR	*	
8	-103.950000	5.000000	37.500000	BK7	C	
Edm sci 53115 DCV 75mm dia, -100 mm fl, Th 5mm?						
9	103.950000 P	13.000000	33.300000	AIR		
10	78.000000	5.000000	37.500000	BK7	C	
Edm sci 53114 DCV 75mm dia, -75mm FL, Th 3 mm						
11	78.000000 P	17.000000	32.800000	AIR		
12	-60.090000	10.320000	32.800000	LLF1	C	
JML	64015 Neg Meniscus LLF1					
13	-607.860000	-32.000000	52.500000	AIR		
IMS	177.800000	--	177.800000 x		*	

331

*SURFACE NOTES

- 2 JML 67891 PCV SF10
- 4 JML 70552 DCX BK7
- 8 Edm Sci 53115 DCV 75mm dia, -100 mm fl, Th 5mm?
- 10 Edm Sci 53114 DCV 75mm dia, -75mm FL, Th 3 mm
- 12 JML 64015 Neg Meniscus LLF1

*ASPHERIC SURFACE DATA

7	ASP ASR	10 - SYMMETRIC GENERAL ASPHERE
	AS0	AS1 -0.005597 AS2 4.4030e-08 AS3
	AS4	AS5 --

332

*SURFACE TAG DATA

- 14 ASI 1
- DRW ON

*REFRACTIVE INDICES

SFR	GLASS	RN1	RN2	RN3	VNBR	TCE
0	AIR	1.000000	1.000000	1.000000	--	--
1	AIR	1.000000	1.000000	1.000000	--	236.000000
2	SF10	1.728250	1.746482	1.720848	28.409716	75.000000
3	AIR	1.000000	1.000000	1.000000	--	236.000000
4	BK7	1.516800	1.522376	1.514322	64.166410	71.000000
5	AIR	1.000000	1.000000	1.000000	--	236.000000
6	CARBO	1.585469	1.599220	1.579900	30.303790	--
7	AIR	1.000000	1.000000	1.000000	--	236.000000
8	BK7	1.516800	1.522376	1.514322	64.166410	71.000000
9	AIR	1.000000	1.000000	1.000000	--	236.000000
10	BK7	1.516800	1.522376	1.514322	64.166410	71.000000
11	AIR	1.000000	1.000000	1.000000	--	236.000000
12	LLF1	1.548140	1.556547	1.544566	45.749335	81.000000
13	AIR	1.000000	1.000000	1.000000	--	236.000000
14	IMAGE SURFACE					

333

FIG. 3C

*APERTURES

SRF	TYPE	APERTURE RADIUS
0	SPC	292.000000
1	SPC	10.000000
2	SPC	22.000000
3	PKP	22.000000
4	SPC	23.240000
5	PKP	23.240000
6	SPC	30.000000
7	SPC	30.000000
8	SPC	37.500000
9	SPC	33.300000
10	SPC	37.500000
11	SPC	32.800000
12	SPC	32.800000
13	SPC	52.500000
14	SPC	177.800000

Special Aperture Group 0:

A	ATP	Ellipse	AAC	Pass Thru	AAN	--		
	AX1	-70.000000	AX2	70.000000	AY1	-70.000000	AY2	70.000000

*WAVELENGTHS

CURRENT	wv1/ww1	wv2/ww2	wv3/ww3
1	0.587560	0.486130	0.656270
	1.000000	1.000000	1.000000

*PARAXIAL SETUP OF LENS

APERTURE

Entrance beam radius:	0.724036	Image axial ray slope:	0.010000
Object num. Aperture:	0.000453	F-number:	-37.131424
Image num. Aperture: *	0.010000	Working F-number:	50.000000

FIELD

Field angle:	10.342657	Object height: *	292.000000
Gaussian image height:	-13.213647	Chief ray ims height:	19.605736

CONJUGATES

Object distance:	-1.6000e+03	Srf 1 to prin. pt. 1:	358.025381
Gaussian image dist.:	-55.481113	Srf 13 to prin. pt. 2:	0.720991
Overall lens length:	225.842060	Total track length:	-1.4062e+03
Paraxial magnification:	-0.045252	Srf 13 to image srf:	-32.000000

OTHER DATA

Entrance pupil radius:	0.724036	Srf 1 to entrance pup.:	--
Exit pupil radius:	0.094539	Srf 13 to exit pupil:	-46.027214
Lagrange invariant:	-0.132136	Petzval radius:	54.277855
Effective focal length:	-53.768941		

SPOT DIAGRAMS

Aperture divisions:	17.030000	Gaussian apod. spec.:	Off
X 1/e^2 entr. irr.:	1.000000	Y 1/e^2 entr. irr.:	1.000000

Note: This optical system contains special surface data.

Calculations based on a paraxial raytrace may be invalid.

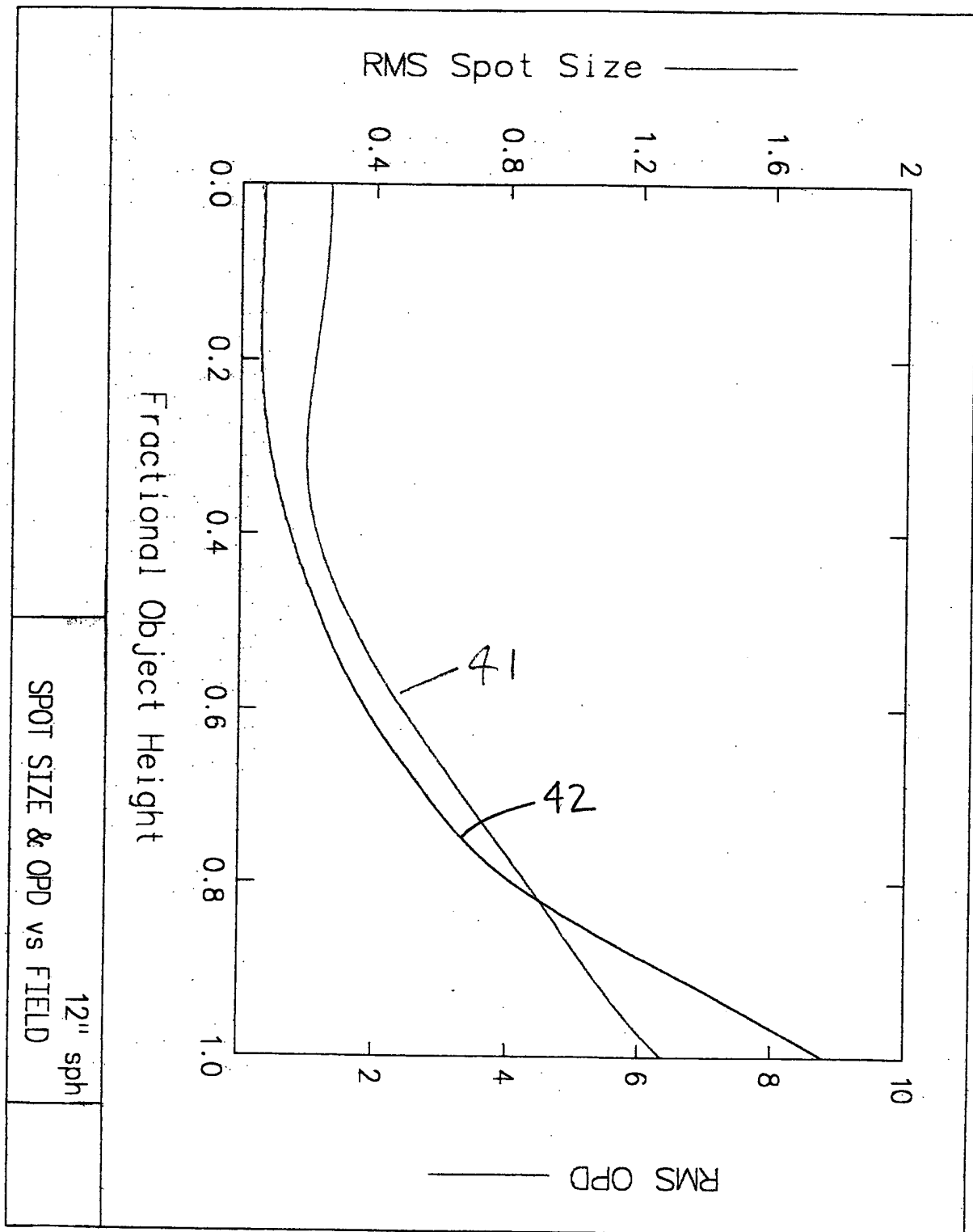


FIG. 4A

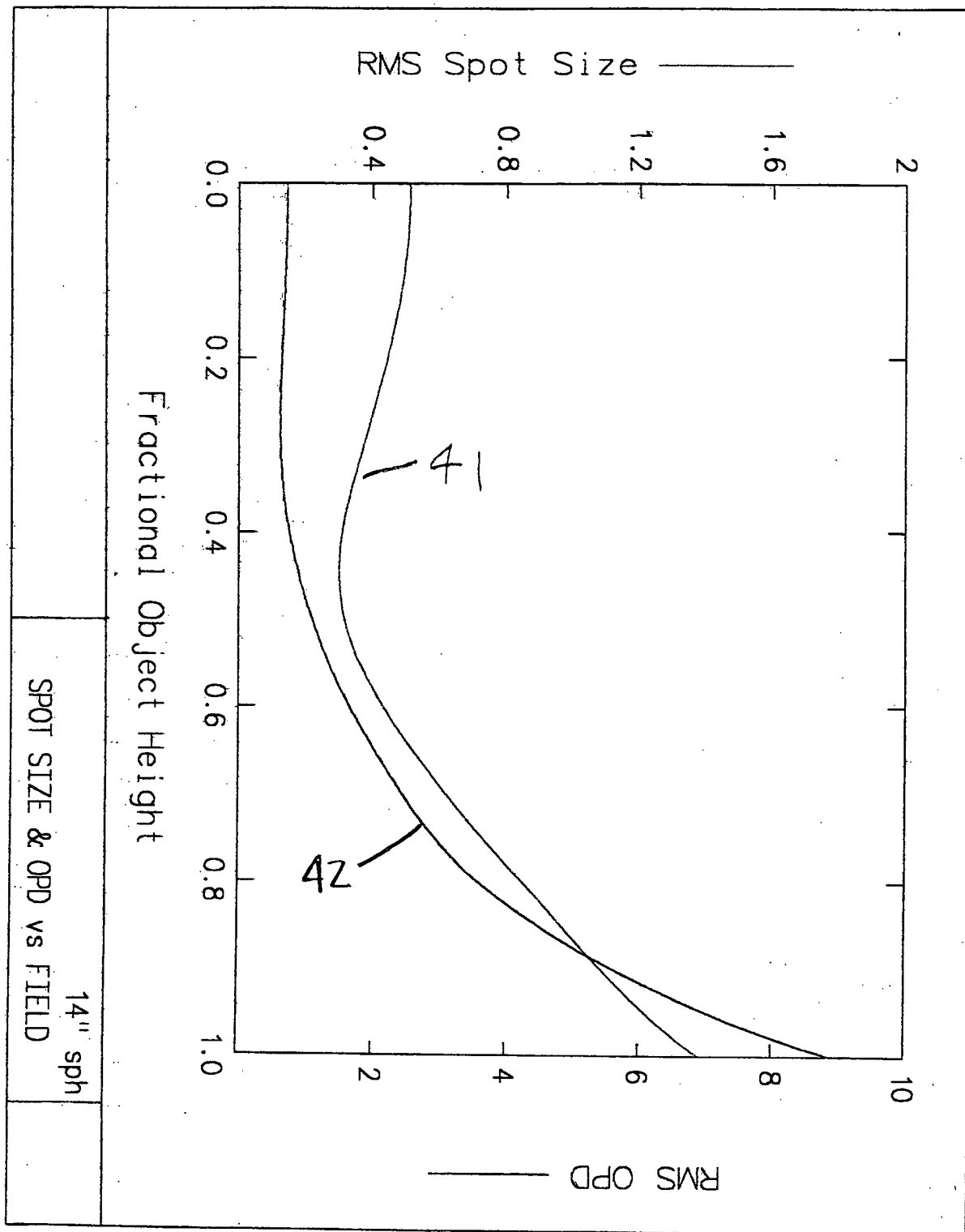


FIG. 4B

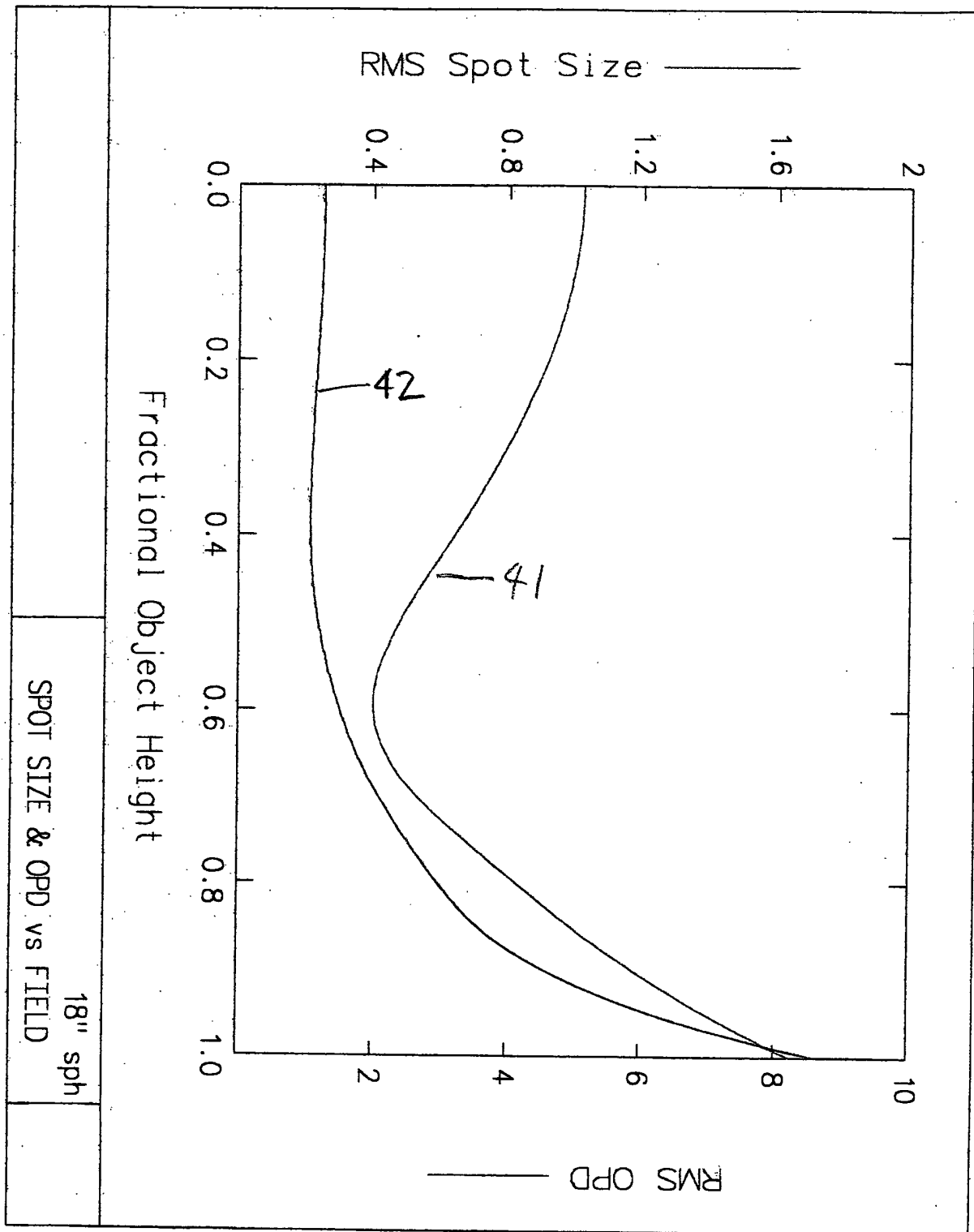


FIG. 4C

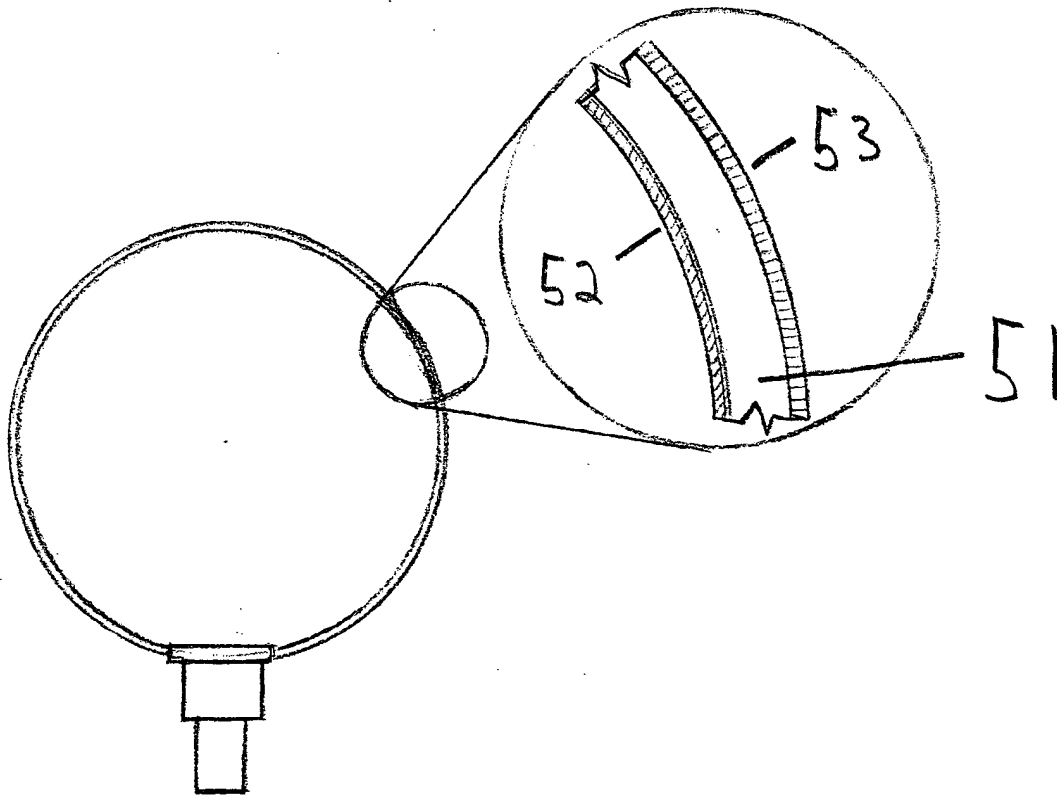


FIG. 5

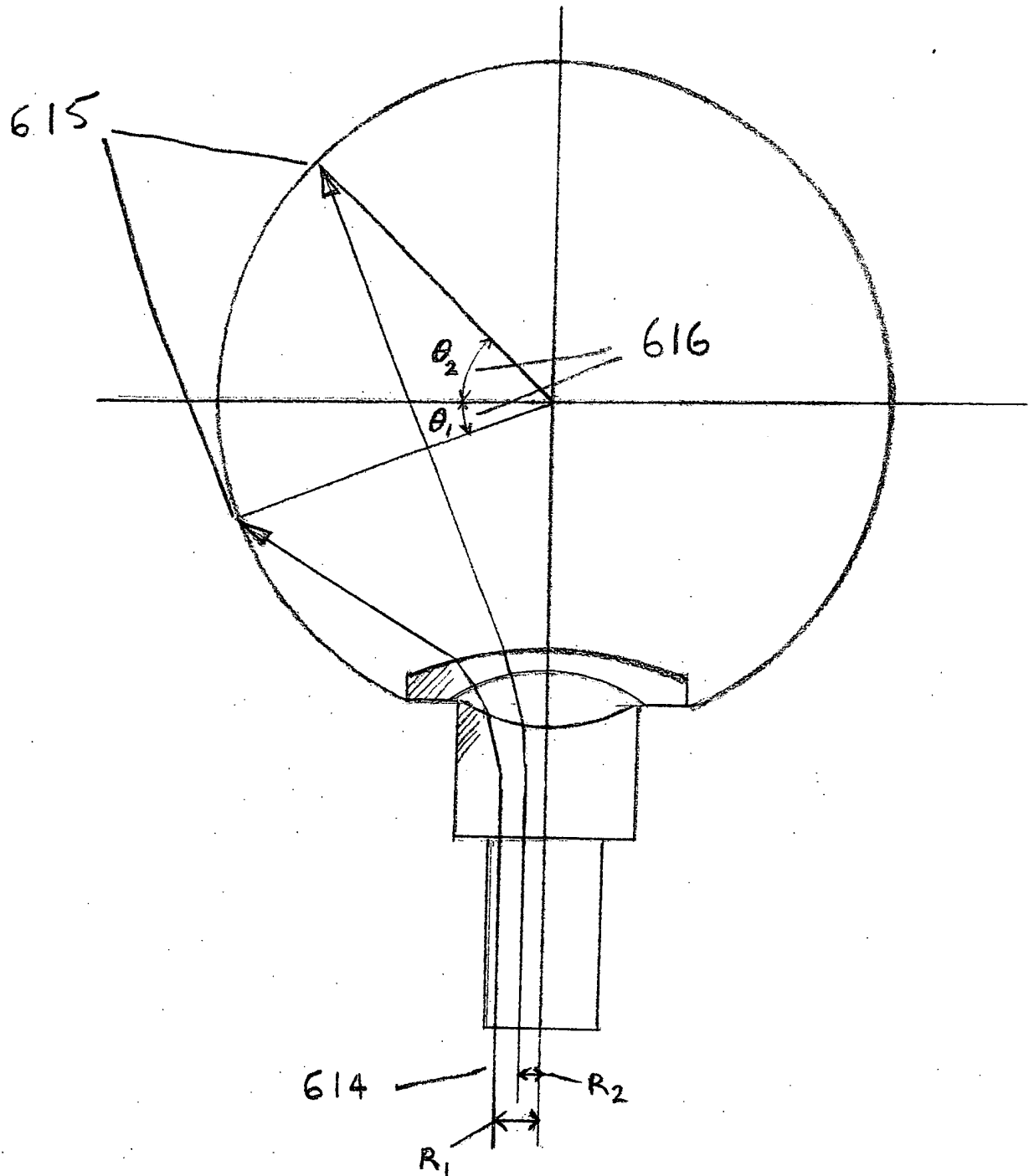


FIG. 6A

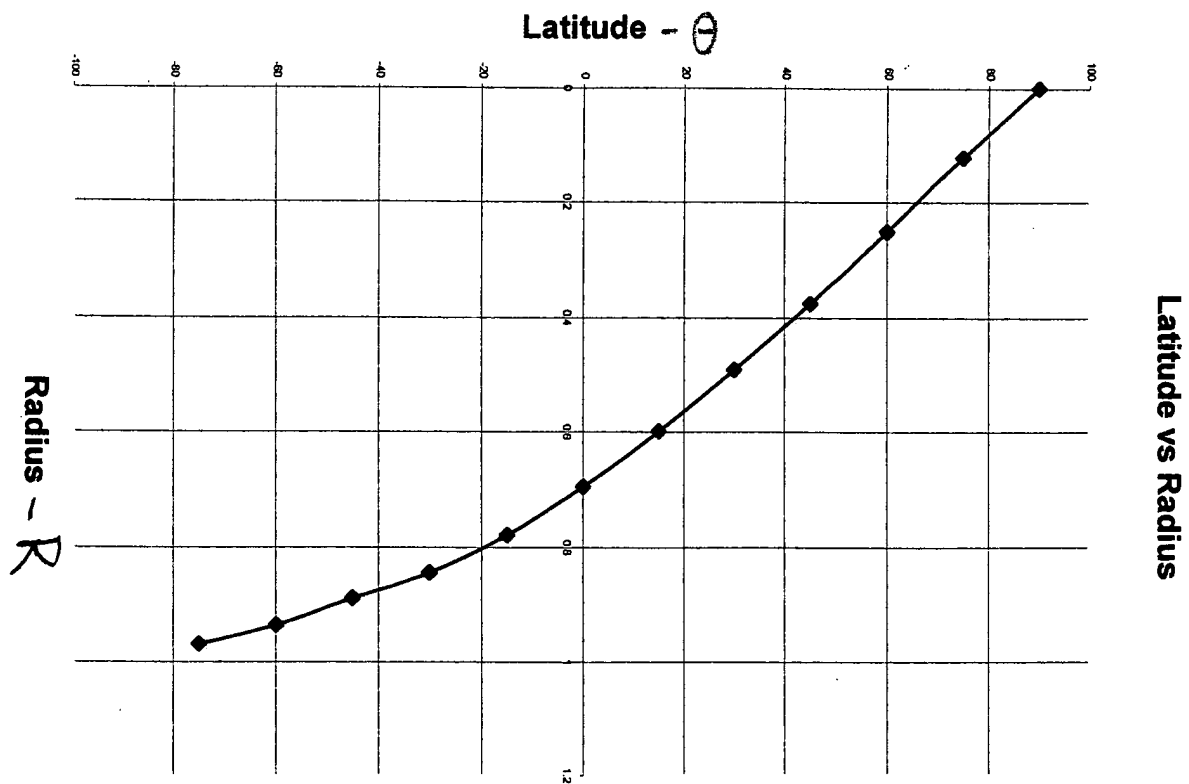


FIG. 6 B

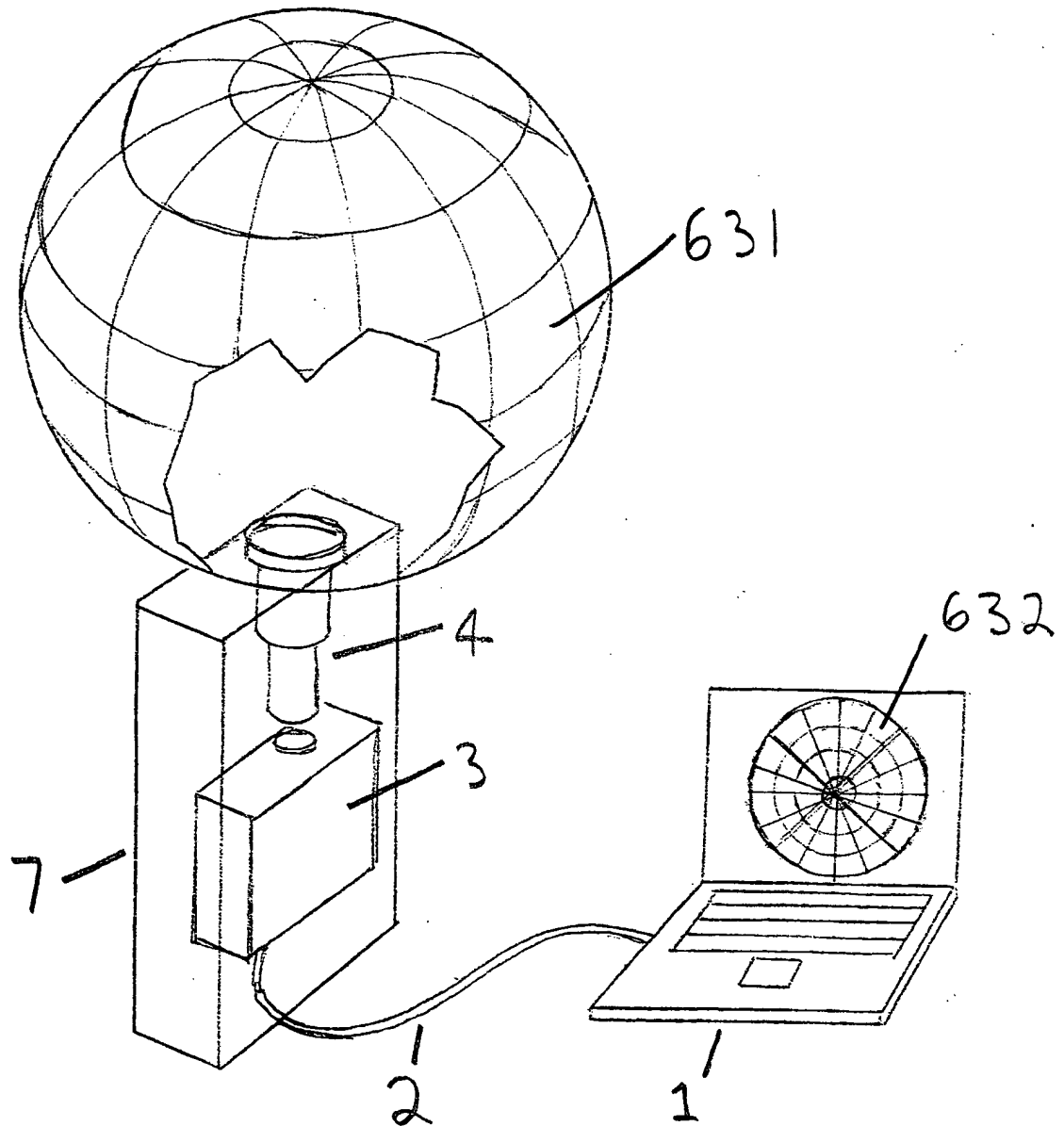


FIG. 6C

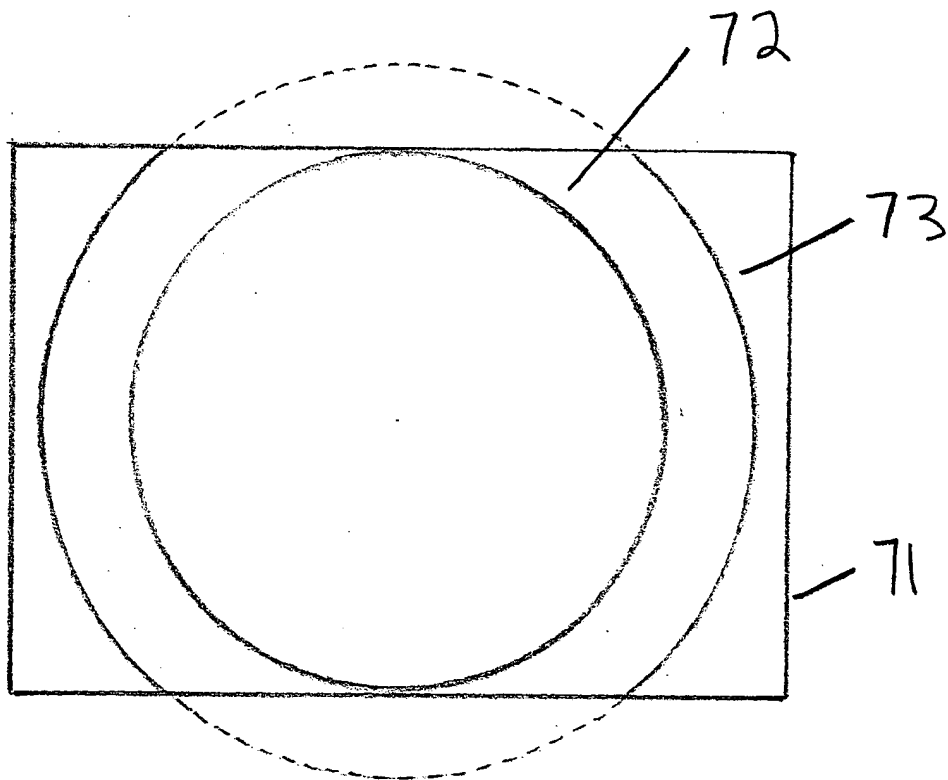


FIG. 7

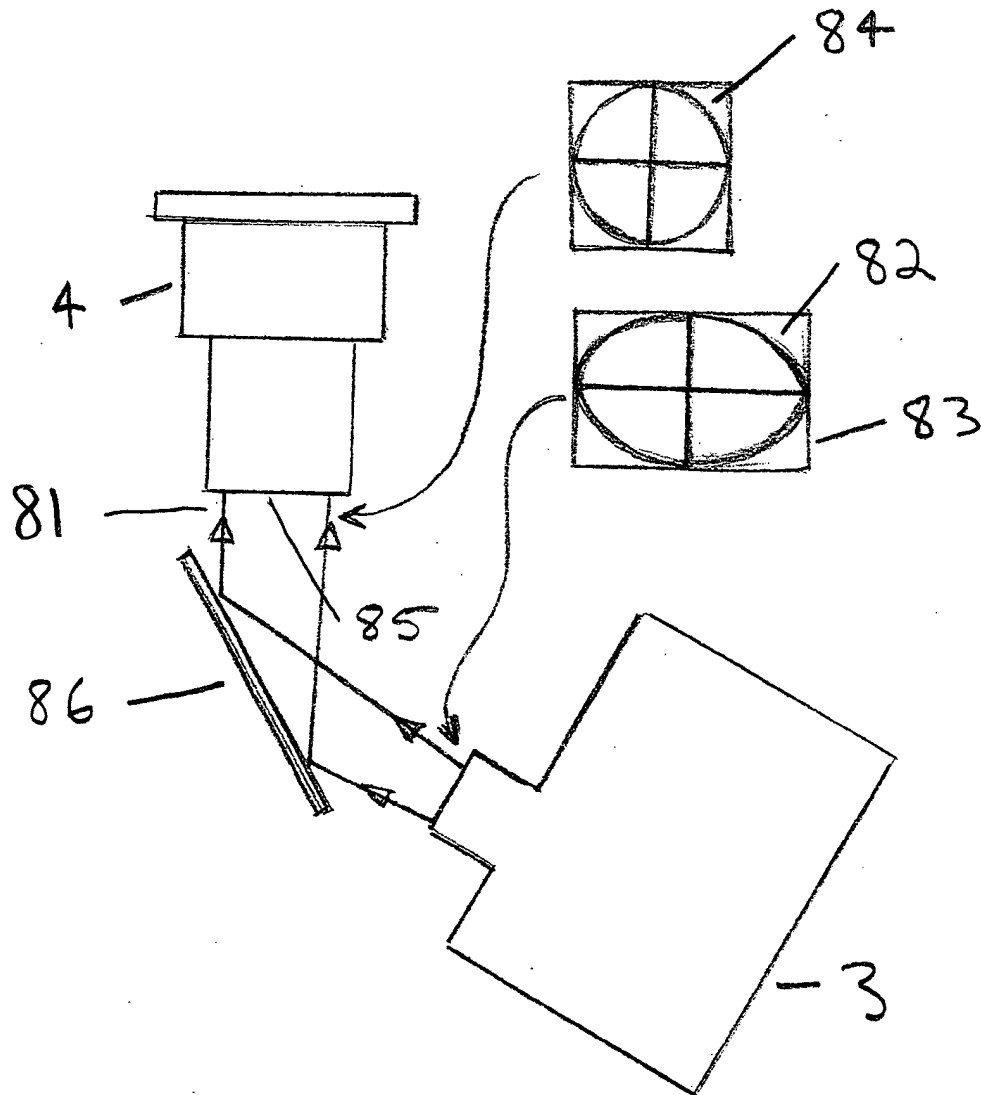


FIG. 8

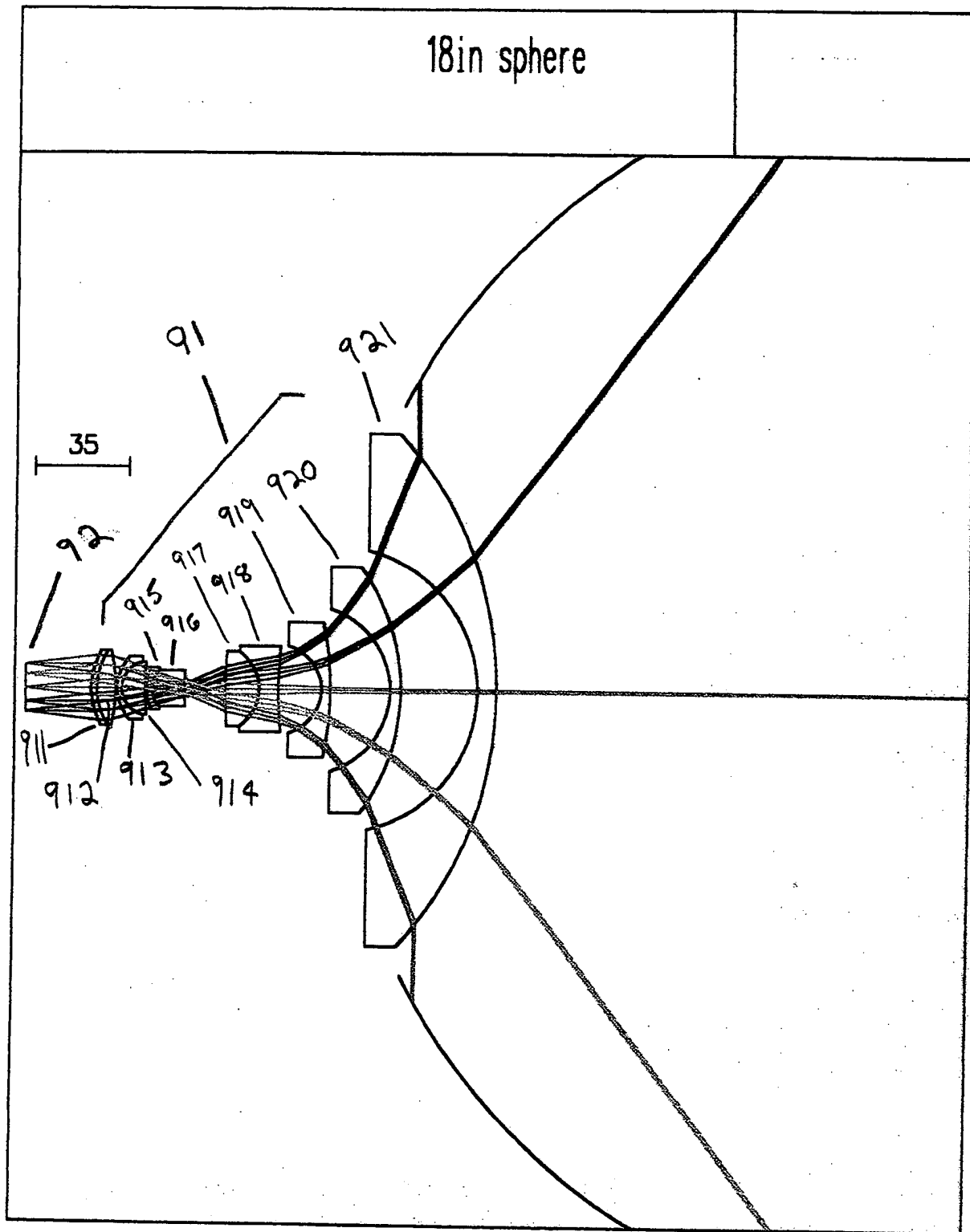


FIG. 9A

*LENS DATA

18in sphere

SRF OBJ	CURVATURE --	THICKNESS 24.700000	APERTURE RADIUS 9.000000	GLASS AIR	SPE *	NOTE
1	0.032916 V	2.000000	14.000000	SF1 C		
2	0.037270 V	6.999999 V	14.000000	SK11 C		
3	-0.017675 V	0.500000	14.000000	AIR		
4	0.054772 V	1.600000	11.000000	LAFN7 C		
5	0.096657 V	8.762197 V	10.000000	KF3 C		
6	0.007371 V	0.500000	10.000000	AIR		
7	0.042506 V	2.000000	8.000000	SF11 C		
8	0.098204 V	12.000000	8.000000	KF3 C		
9	0.010972 V	1.400000	8.000000	AIR		
AST	--	13.800000	2.875605 AS	AIR		
11	0.005249 V	12.600000	14.000000	SF10 C		
12	-0.058288 V	7.000000	14.000000	SK16 C		
13	0.006234 V	15.00000	16.000000	AIR		
14	-0.058480	3.000000	16.300000	BK7 C		
15	-0.008000	21.800000	25.000000	AIR		
16	-0.031725	3.800000	30.000000	BK7 C		
17	-0.013089	28.000000	45.000000	AIR		
18	-0.019048	7.000000	51.000000	BK7 C		
19	-0.006970	-60.000000	95.000000	AIR		
IMS	0.004374	--	230.000000 X		*	

*REFRACTIVE INDICES

SFR	GLASS	RN1	RN2	RN3	VNBR	TCE
0	AIR	1.000000	1.000000	1.000000	--	--
1	SF1	1.717360	1.734621	1.710313	29.511275	81.000000
2	SK11	1.563840	1.570284	1.561010	60.795650	65.000000
3	AIR	1.000000	1.000000	1.000000	--	236.000000
4	LAFN7	1.749502	1.764639	1.743193	34.948736	53.000000
5	KF3	1.514540	1.521099	1.511692	54.699656	81.000000
6	AIR	1.000000	1.000000	1.000000	--	236.000000
7	SF11	1.784720	1.806455	1.775987	25.755289	61.000000
8	KF3	1.514540	1.521099	1.511692	54.699656	81.000000
9	AIR	1.000000	1.000000	1.000000	--	236.000000
10	AIR	1.000000	1.000000	1.000000	--	236.000000
11	SF10	1.728250	1.746482	1.720847	28.408719	75.000000
12	SK16	1.620410	1.627557	1.617271	60.320455	63.000000
13	AIR	1.000000	1.000000	1.000000	--	236.000000
14	BK7	1.516800	1.522376	1.514322	64.163927	71.000000
15	AIR	1.000000	1.000000	1.000000	--	236.000000
16	BK7	1.516800	1.522376	1.514322	64.163927	71.000000
17	AIR	1.000000	1.000000	1.000000	--	236.000000
18	BK7	1.516800	1.522376	1.514322	64.163927	71.000000
19	AIR	1.000000	1.000000	1.000000	--	236.000000
20	IMAGE SURFACE					

FIG. 9B

*APERTURES

SRF	TYPE	APERTURE RADIUS
0	SPC	9.000000
1	SPC	14.000000
2	SPC	14.000000
3	SPC	14.000000
4	SPC	11.000000
5	SPC	10.000000
6	SPC	10.000000
7	SPC	8.000000
8	SPC	8.000000
9	SPC	8.000000
10	CMP	2.875605
11	SPC	14.000000
12	SPC	14.000000
13	SPC	16.000000
14	SPC	16.300000
15	SPC	25.000000
16	SPC	30.000000
17	SPC	45.000000
18	SPC	51.000000
19	SPC	95.000000
20	SPC	230.000000

Special Aperture Group 0:

A	ATP	Ellipse	AAC	Pass Thru	AAN	--		
	AX1	-105.000000	AX2	105.000000	AY1	-105.000000	AY2	105.000000

*WAVELENGTHS

CURRENT	ww1/ww1	ww2/ww2	ww3/ww3
1	0.587560	0.486130	0.656280
	1.000000	1.000000	1.000000

*PARAXIAL SETUP OF LENS

APERTURE

Entrance beam radius: *	3.000000	Image axial ray slope:	-0.001528
Object num. aperture:	0.120571	F-number:	2.4346e-19
Image num. aperture:	0.001517	Working F-number:	329.596329

FIELD

Field angle:	5.1566e-18	Object height: *	-9.000000
Gaussian image height:	715.318127	Chief ray ims height:	-13.092823

CONJUGATES

Object distance:	24.700000	Srf 1 to prin. pt. 1:	-18.711634
Gaussian image dist.:	418.643524	Srf 19 to prin. pt. 2:	-57.310580
Overall lens length:	148.262197	Total track length:	112.962197
Paraxial magnification:	-79.479792	Srf 19 to image srf:	-60.000000

OTHER DATA

Entrance pupil radius:	1.2146e+19	Srf 1 to entrance pup.:	1.0000e+20
Exit pupil radius:	0.718294	Srf 19 to exit pupil:	-51.396622
Lagrange invariant:	-1.093117	Petzval radius:	-100.672057
Effective focal length:	5.913958		

SPOT DIAGRAMS

Aperture divisions:	32.000000	Gaussian apod. spec.:	Off
X 1/e^2 entr. irr.:	1.000000	Y 1/e^2 entr. irr.:	1.000000

Note: This optical system contains special surface data.

Calculations based on a paraxial raytrace may be invalid.

FIG. 9B continued

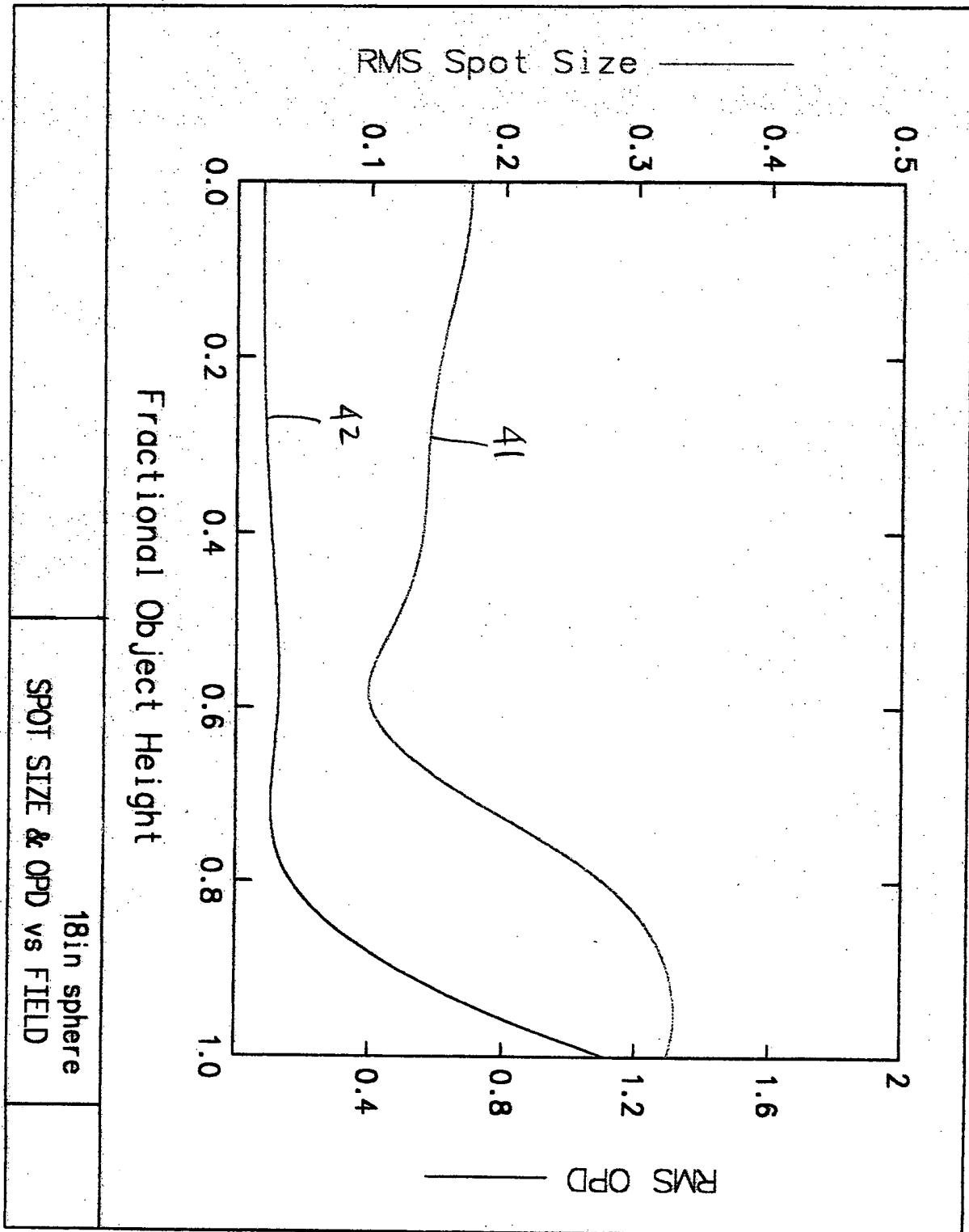


FIG. 9C

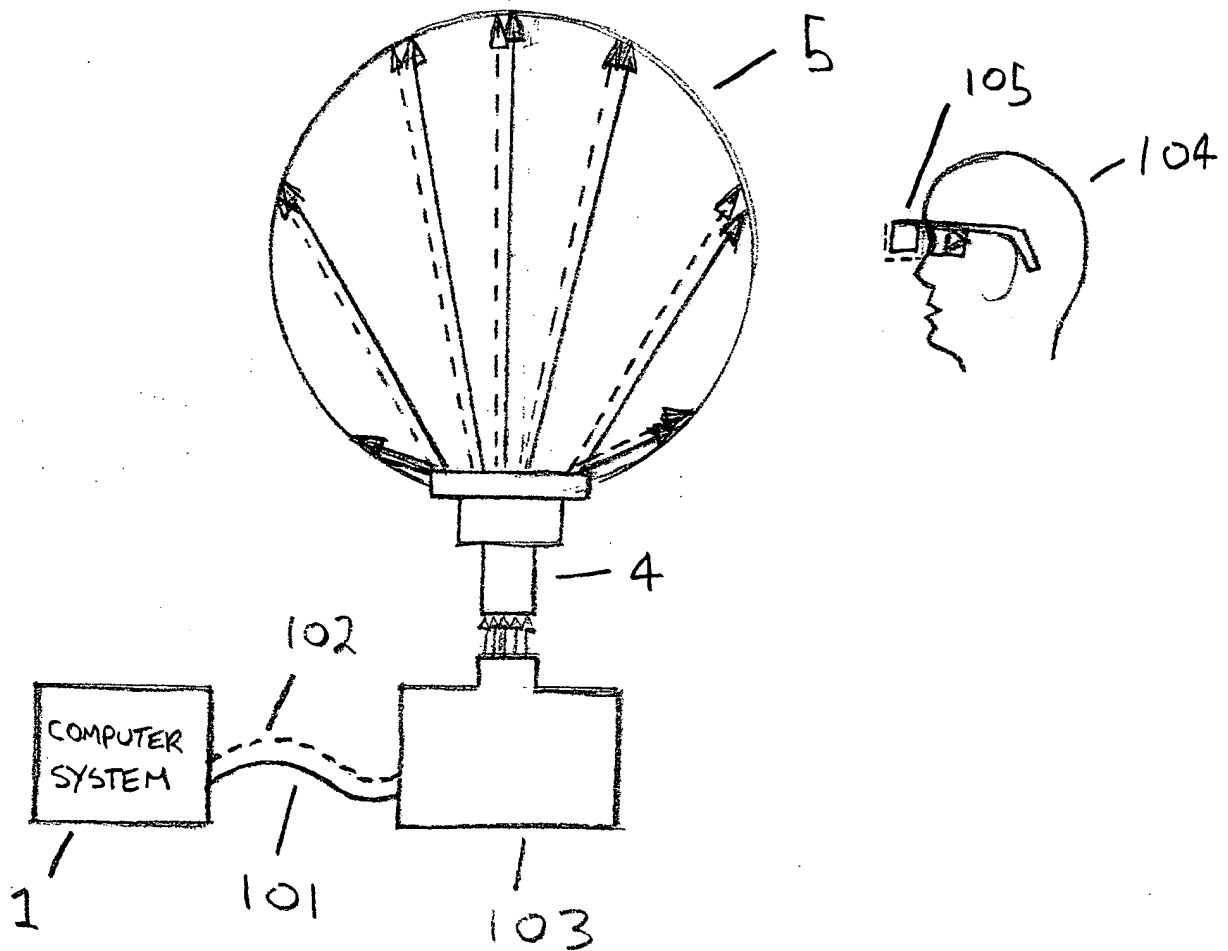


FIG. 10

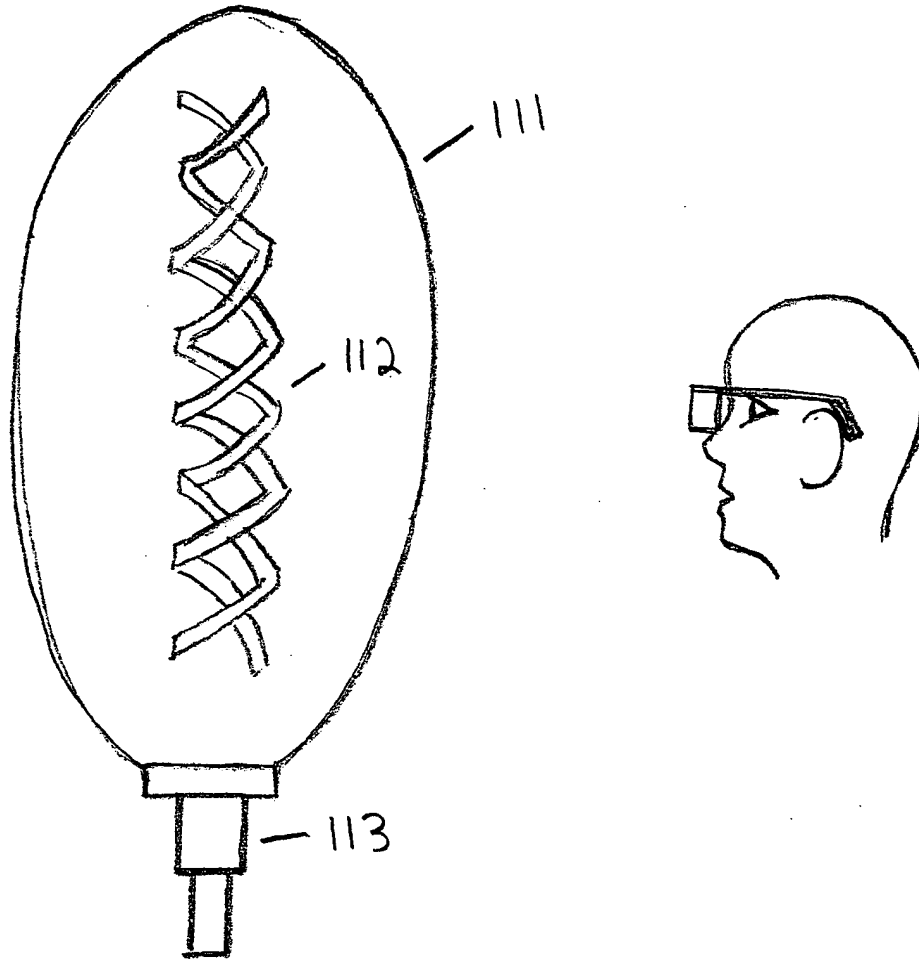


FIG. 11A

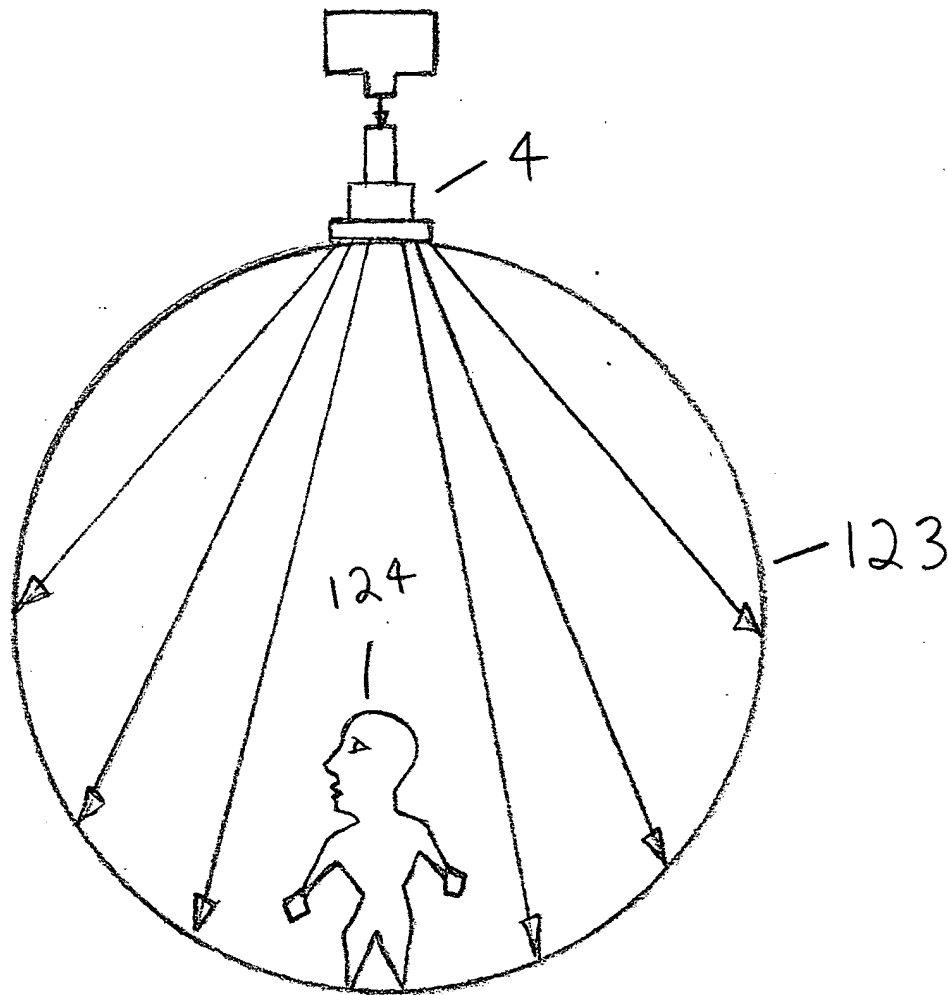


FIG. 11 B

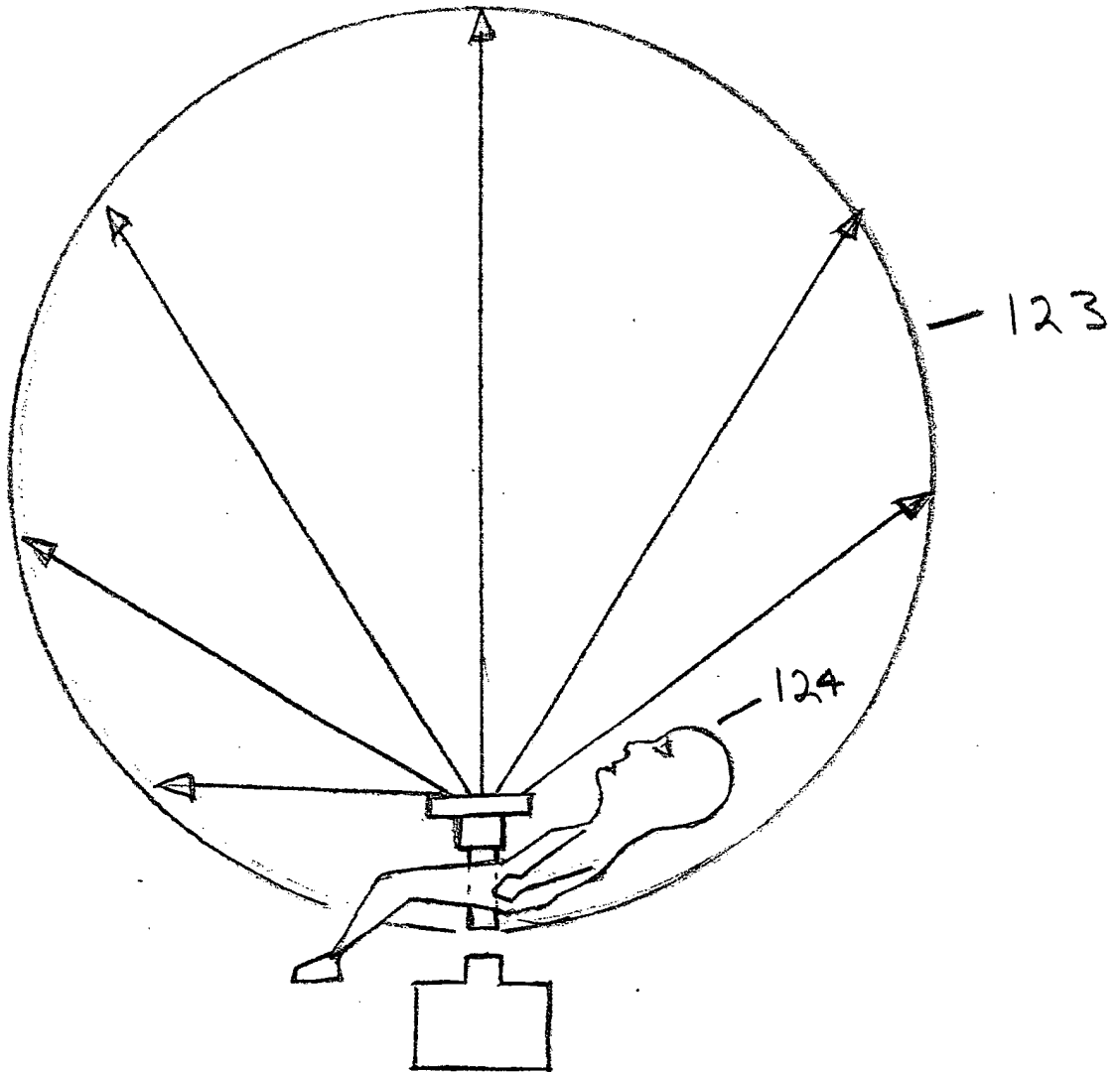


FIG. 11C

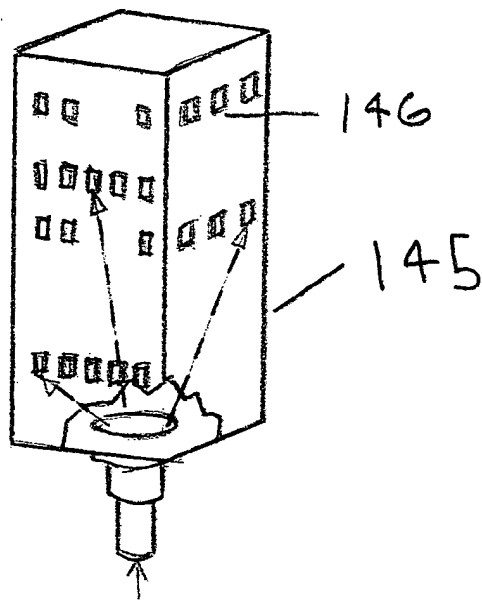


FIG. 11D

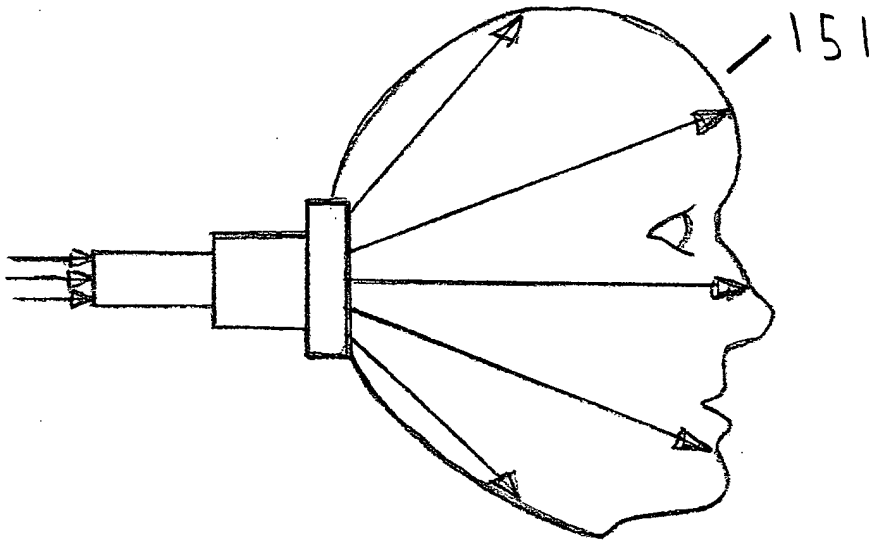


FIG. 11E

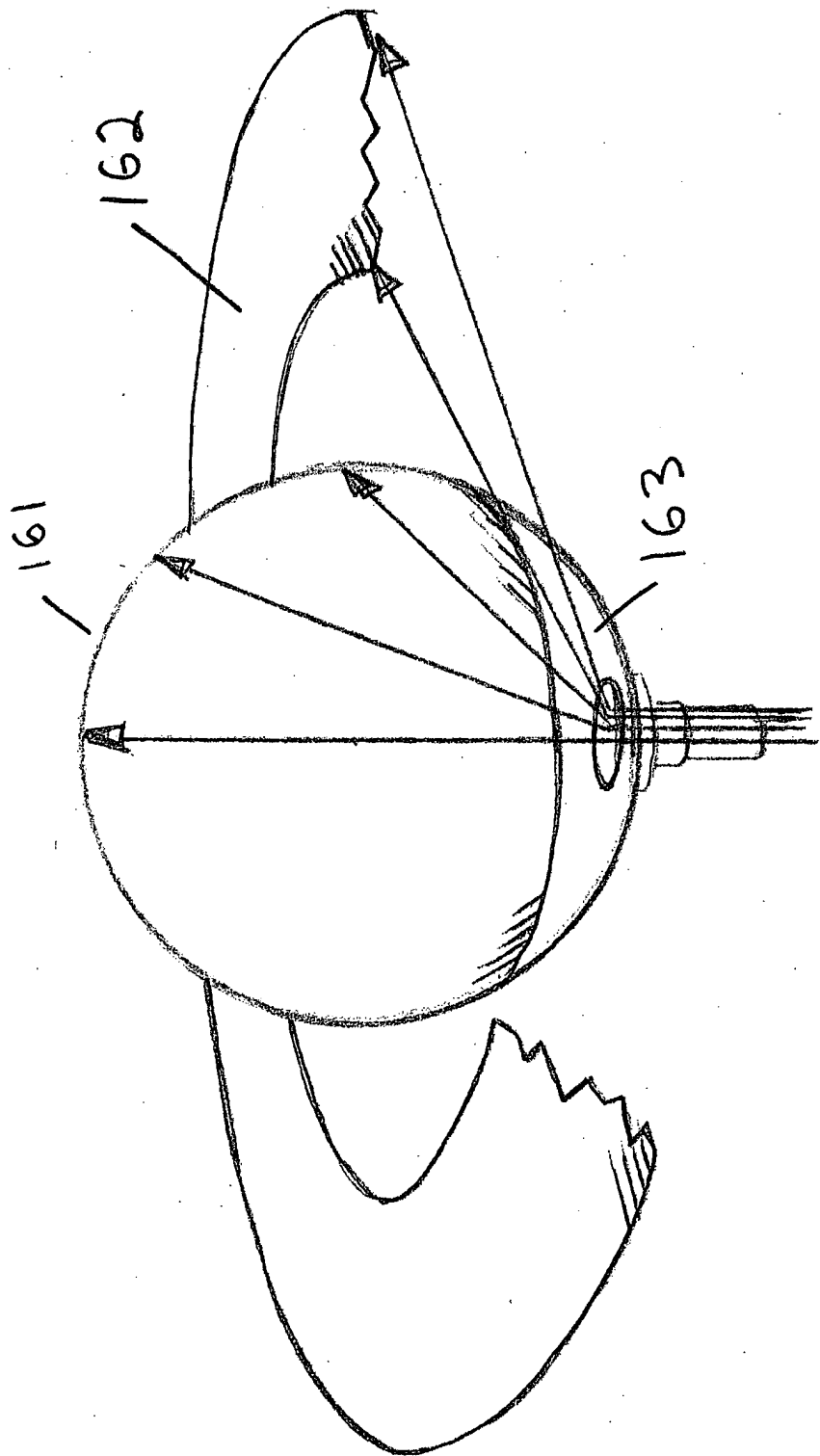


FIG. 11F

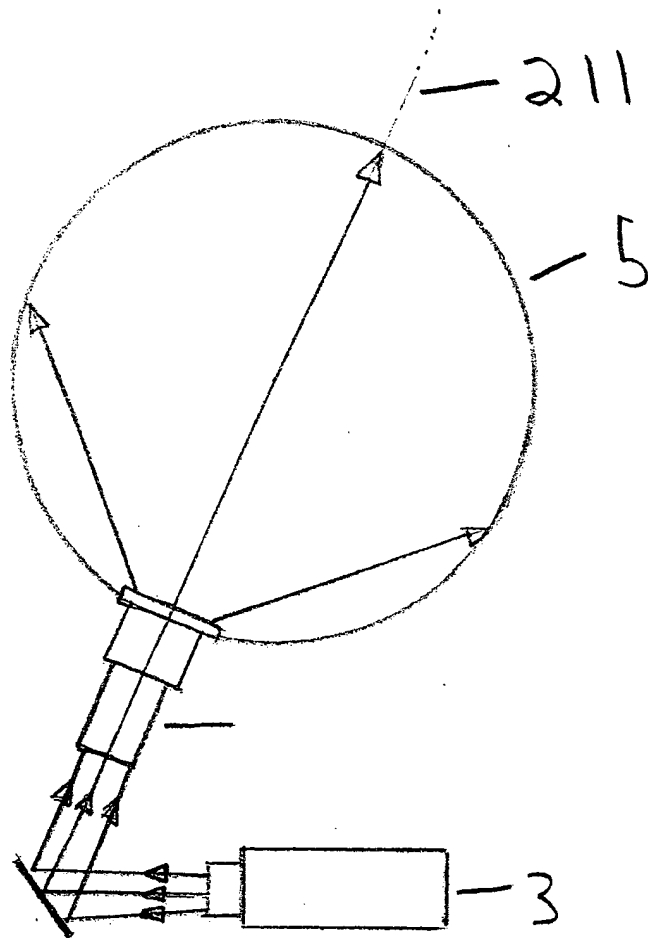


FIG. 12A

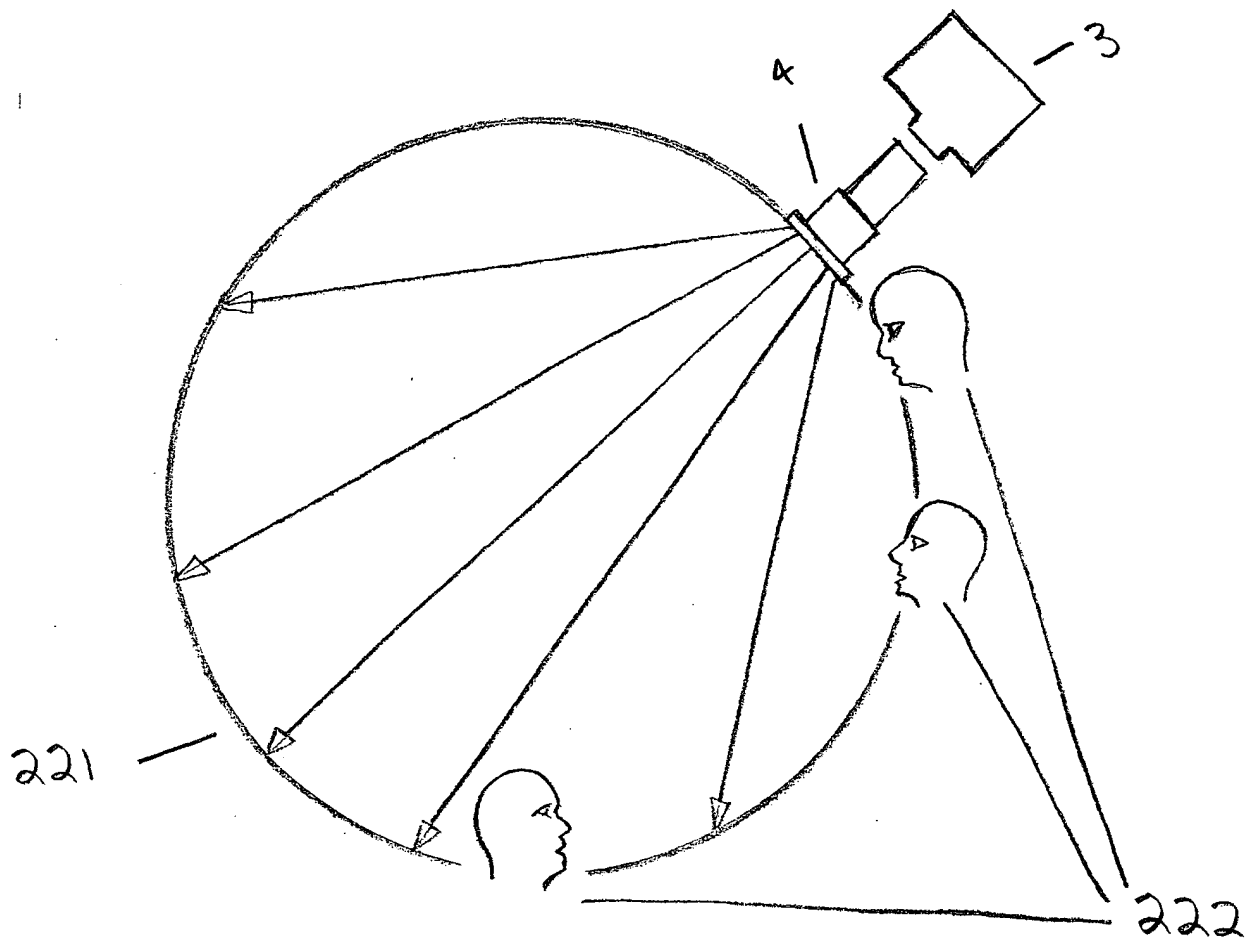


FIG. 12 B

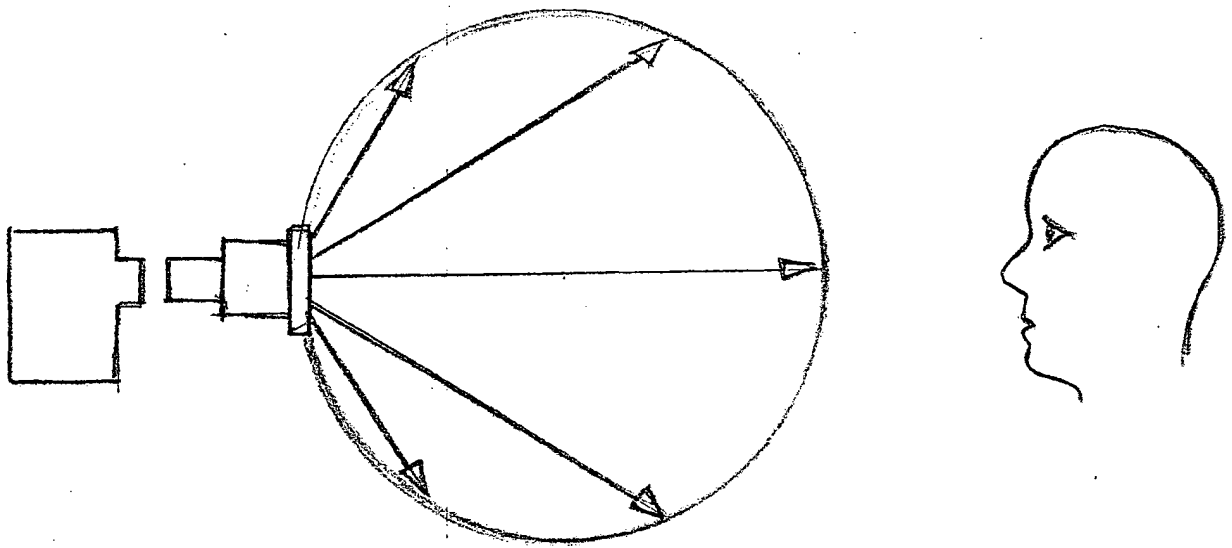


FIG. 12C